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August 31, 2020

Reference No. 1801-S032

Page 1 of 4

Zancor Homes (Bolton) Ltd.  
221 North Rivermede Road  
Concord, Ontario  
L4K 3N7

Attention: Mr. Frank Filippo

**Re: A Supplementary Slope Stability Assessment for  
Proposed Residential Development  
Chickadee Lane and Glasgow Road  
Town of Caledon**

Dear Sir:

As requested, Soil Engineers Ltd. has carried out a supplementary slope stability assessment in Blocks 27, 29, 30 and 31 of the captioned site to further delineate the Long-Term Stable Slope Line (LTSSL). We herein provide a summary of our findings and analytical results of the concerned slope.

## **Background**

The subject site is located at the intersection of Chickadee Lane and Glasgow Road, in the Town of Caledon. The concerned slope is located at the west limit of the subject site in Blocks 27, 29, 30 and 31. The height of the slope varies from 10 to 30 m, having a gradient of 1.6 to 5+ horizontal (H): 1 vertical (V). Humber River is more than 15 m away from the bottom of slope.

## **Subsurface Investigation**

A geotechnical investigation report, Reference No. 1801-S032, dated July 2018 was completed for the subject site. Three (3) sampled boreholes (Boreholes 1 to 3, inclusive) were located in the vicinity of the concerned slope. The boreholes indicated that topsoil, 160 mm to 260 mm in thickness, was encountered at the surface of the area. Beneath the topsoil veneer, the subsoil generally consisted of firm to hard silty clay till deposit extending to a depth of 16.4 m from the prevailing ground surface, overlying compact to dense sandy silt till deposit to the maximum investigated depth of the borehole at 19.8 m from the ground surface.



Groundwater level was recorded at El. 252.7 m in Borehole 2 upon completion of the drilling program. Boreholes 1 and 3 remained dry on completion. The recorded groundwater represents a perched water condition within the till mantle and will fluctuate with seasons.

### Visual Inspection

Visual inspection was performed on March 20, 2018 during the original study. The inspection revealed that the sloping ground is generally covered with mature trees or vegetation, with isolated bare spots covered with fallen leaves and wood branches. Most of the trees appeared in the upright position. There were no signs of water seepage or surface erosion along the slope surface, except multiple gullies and surface erosion were present to the north and west of the property. Toe erosion scars were also evident along Humber River.

### Modeling

In addition to the Cross-Section A-A that was analyzed during the original study with the geotechnical investigation, two (2) additional sections (Cross Sections D-D and E-E) are performed to further delineate the LTSSL. The surface profiles of the slope sections are interpreted from the elevation contours shown on the topographic plan obtained from First Base Solutions. The subsurface soil information was derived from the borehole findings. The locations of the cross-sections are shown on Drawing No. 1. The details of the slope at the Cross-Sections A-A, D-D and E-E are presented on Drawing Nos. 2, 3 and 4, respectively.

The analyses were carried out with computer-aided program, SLIDE created by Rocscience Inc., using force-moment-equilibrium criteria with the soil strength parameters shown in the following table:

Soil Type	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Internal Friction Angle (degrees)
Very stiff to hard Silty Clay Till	22.0	5	28
Stiff Silty Clay Till	21.5	5	25
Sandy Silt Till	22.0	5	30

Where applicable, the highest water level detected in the boreholes and the creek level were incorporated into the analysis as a phreatic surface.

### Results

The results of the analyses are summarized in the following table and are presented on Drawing Nos. 2, 3 and 4.



Cross Section	Height (m)	Existing Slope Gradient	Factor of Safety (FOS)	Remodeled Slope Gradient	Resulting FOS
A-A	19.0	1.9 to 5.4H:1V	1.39	2.5H:1V	1.61
D-D	8.5	1.6H:1	1.31	2H:1V	1.51
E-E	7.0	3.1 to 4.7H:1V	2.40	-	-

The resulting FOS at the Cross-Section E-E meet the Ontario Ministry of Natural Resources and Forestry (OMNRF) guideline requirement for 'Active' land use (FOS of 1.5), while the FOS for Cross-Sections A-A and D-D is below the OMNRF guideline requirement. A stable slope allowance will be required for Cross-Sections A-A and D-D.

Even though there were active erosion observed at the bank of the Humber River, however, given that the river is more than 15 m away from the bottom of slope, a Toe Erosion Allowance (T.E.A.) is not required.

After incorporating the stable slope gradient of 2.5 to 2.0H:1V at Cross- Sections A-A and D-D, the resulting FOS for the remodeled slope meets the OMNRF guideline of FOS 1.5. The results are presented on Drawing No. 5 and 6.

Based on the analytical results, the LTSSL, incorporating the stable slope gradient, is established and is illustrated in Drawing No. 1.

A development setback buffer for man-made and environmental degradation based on the TRCA policy will be required. This is subject to the discretion of TRCA.

Where grading of the site requires the area to be raised, the proposed slope should maintain a gradient of 1V:3H or flatter for stability. Any slope steeper than 1V:3H will require further stability analysis and it may need to be constructed as a reinforced earth slope.

In order to prevent disturbance of the existing stable slope and to enhance the stability of the bank for the proposed project, the following geotechnical constraints should be stipulated:

1. The prevailing vegetative cover must be maintained, since its extraction would deprive the bank of the rooting system that is reinforcement against soil erosion by weathering. If for any reason the vegetation cover is stripped, it must be reinstated to its original, or better than its original, protective condition.
2. The leafy topsoil cover on the bank face should not be disturbed, since this provides an insulation and screen against frost wedging and rainwash erosion.



3. Grading of the land adjacent to the bank must be such that concentrated runoff is not allowed to drain onto the bank face. Landscaping features which may cause runoff to pond at the top of the bank, as well as saturation of the crown of the bank must not be permitted.
4. Where the construction is carried out near the top of the bank, dumping of loose fill over the bank from topsoil stripping or vegetation removal activities must be prohibited. Topsoil stripping and vegetation removal along the bank are also prohibited.

In case of any removal of vegetation during the course of construction, restoration with selective native plantings, including deep rooting systems which would penetrate the original topsoil, shall be carried out after the development to ensure slope stability. Provided that all the above recommendations are followed, the proposed development at the tableland should not have any adverse effect on the stability of the slope.

The above recommendations should be reviewed and are subject to the approval of TRCA.

We trust the above satisfies your present requirements. Should you have any further queries, please feel free to contact this office.

Yours truly,

**SOIL ENGINEERS LTD.**

Kin Fung Li, P.Eng.  
KFL/BL



Bernard Lee, P.Eng.



**ENCLOSURES**

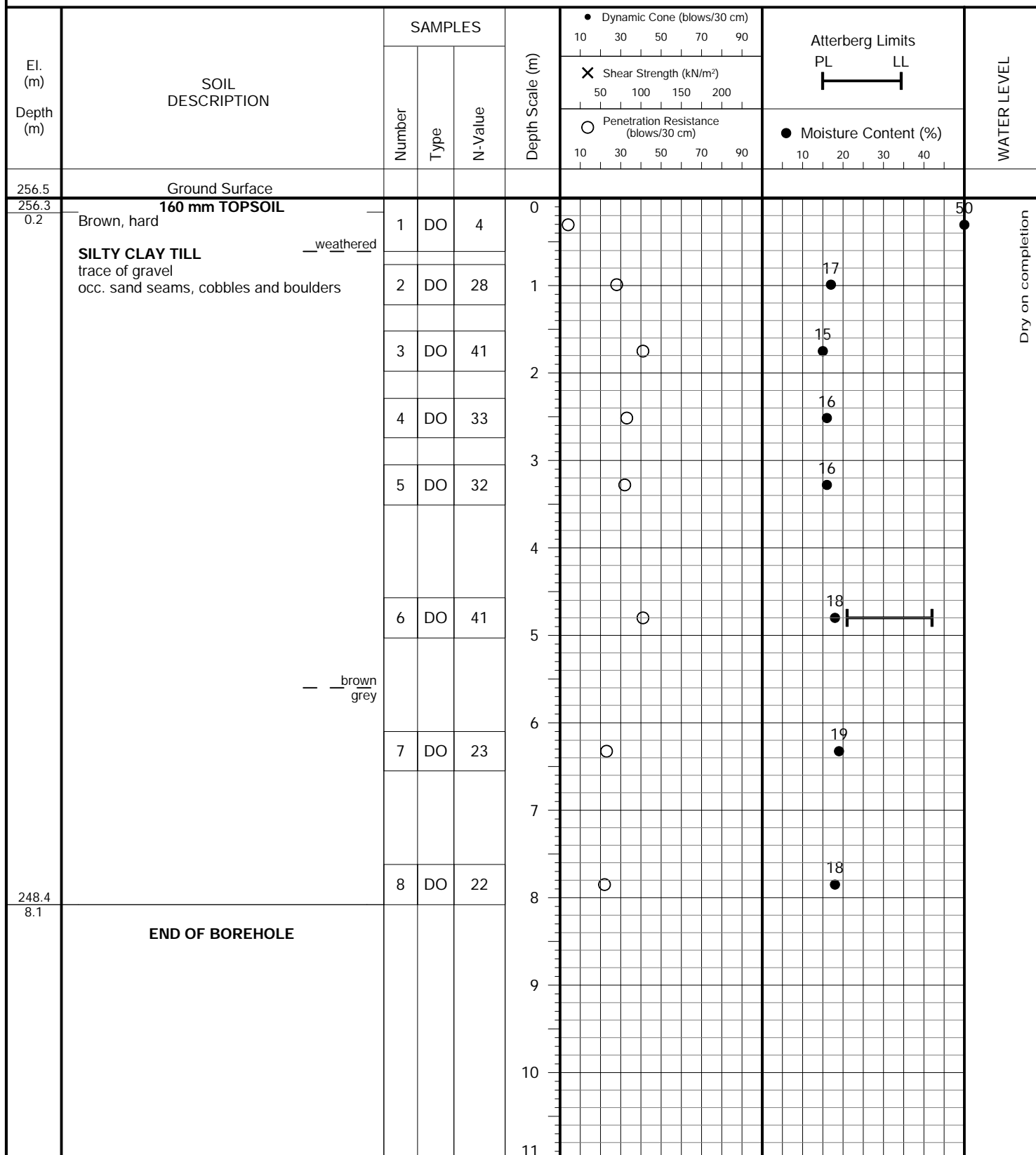
Borehole Logs .....	Figures 1 to 3
Cross Section Location Plan.....	Drawing No. 1
Slope Stability Analyses (Existing Condition).....	Drawing Nos. 2 to 4
Slope Stability Analysis (Geotechnically Stable Condition) .....	Drawing Nos. 5 and 6

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JOB NO.: 1801-S032

**LOG OF BOREHOLE NO.: 1**

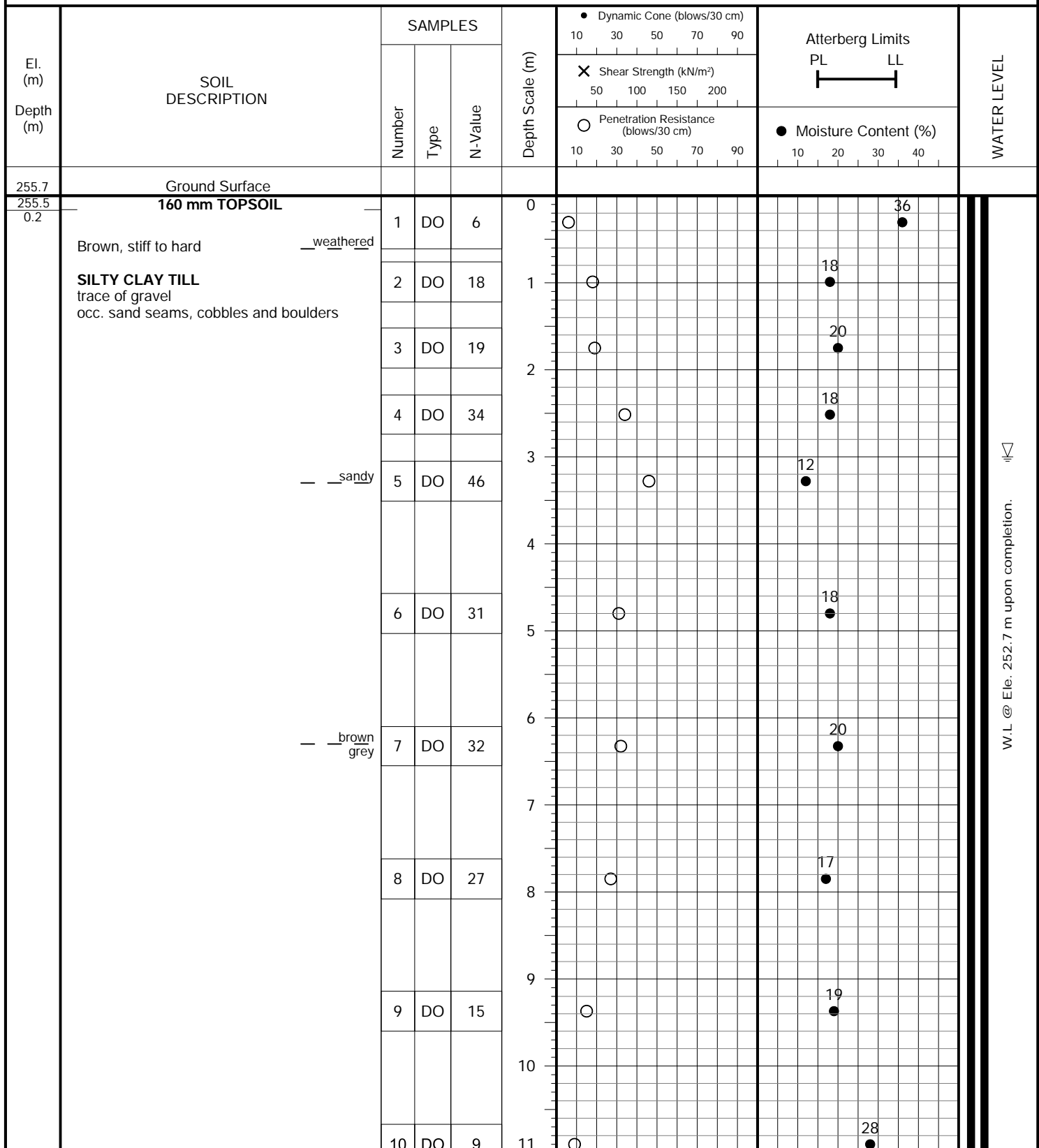
FIGURE NO.: 1

**PROJECT DESCRIPTION:** Proposed Residential Development**METHOD OF BORING:** Flight-Auger  
(Solid-Stem)**PROJECT LOCATION:** Chickadee Lane and Glasgow Road, Town of Caledon**DRILLING DATE:** January 26, 2018**Soil Engineers Ltd.**

JOB NO.: 1801-S032

**LOG OF BOREHOLE NO.: 2**

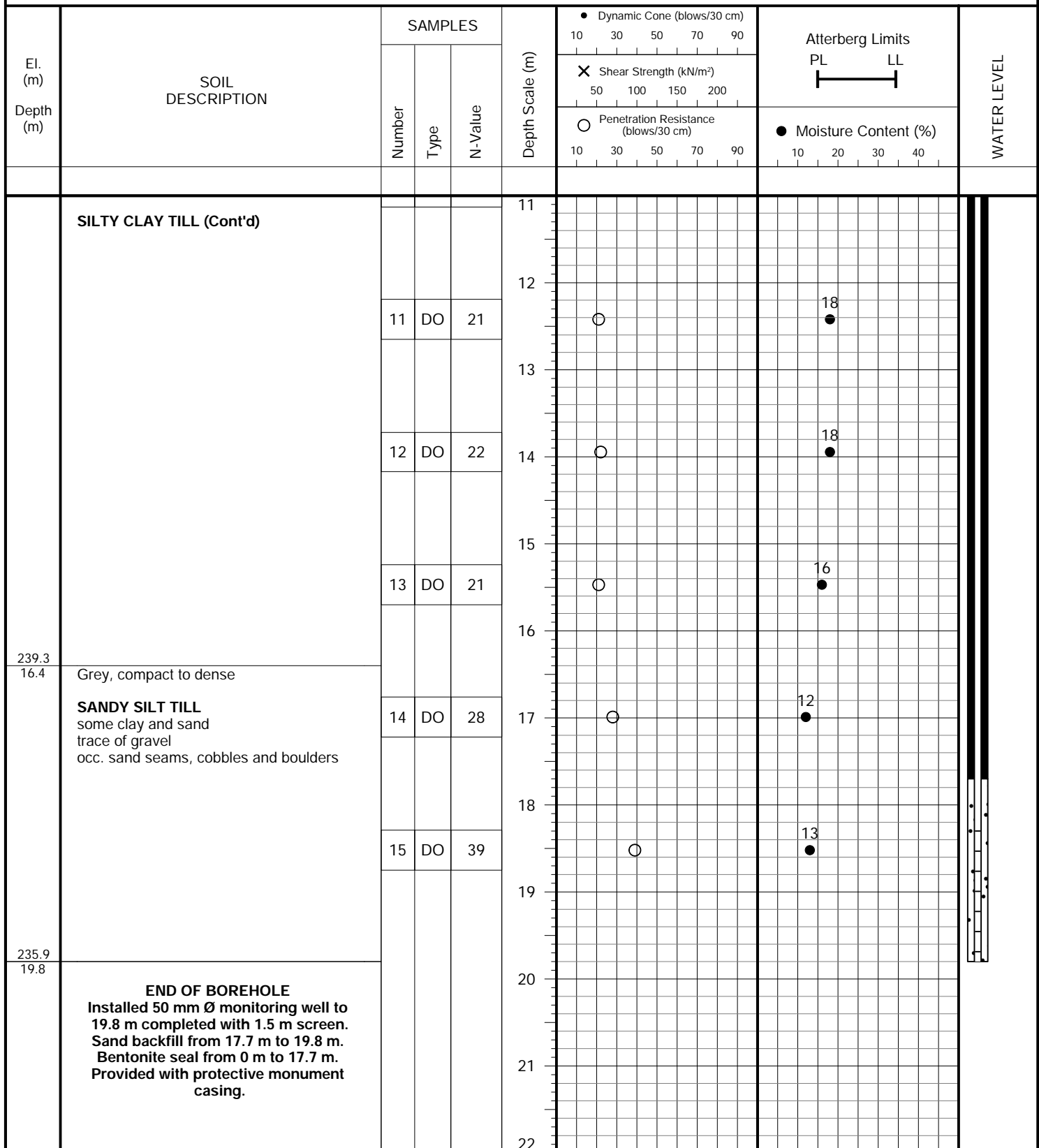
FIGURE NO.: 2

**PROJECT DESCRIPTION:** Proposed Residential Development**METHOD OF BORING:** Flight-Auger  
(Solid-Stem)**PROJECT LOCATION:** Chickadee Lane and Glasgow Road, Town of Caledon**DRILLING DATE:** January 26, 2018**Soil Engineers Ltd.**

JOB NO.: 1801-S032

**LOG OF BOREHOLE NO.: 2**

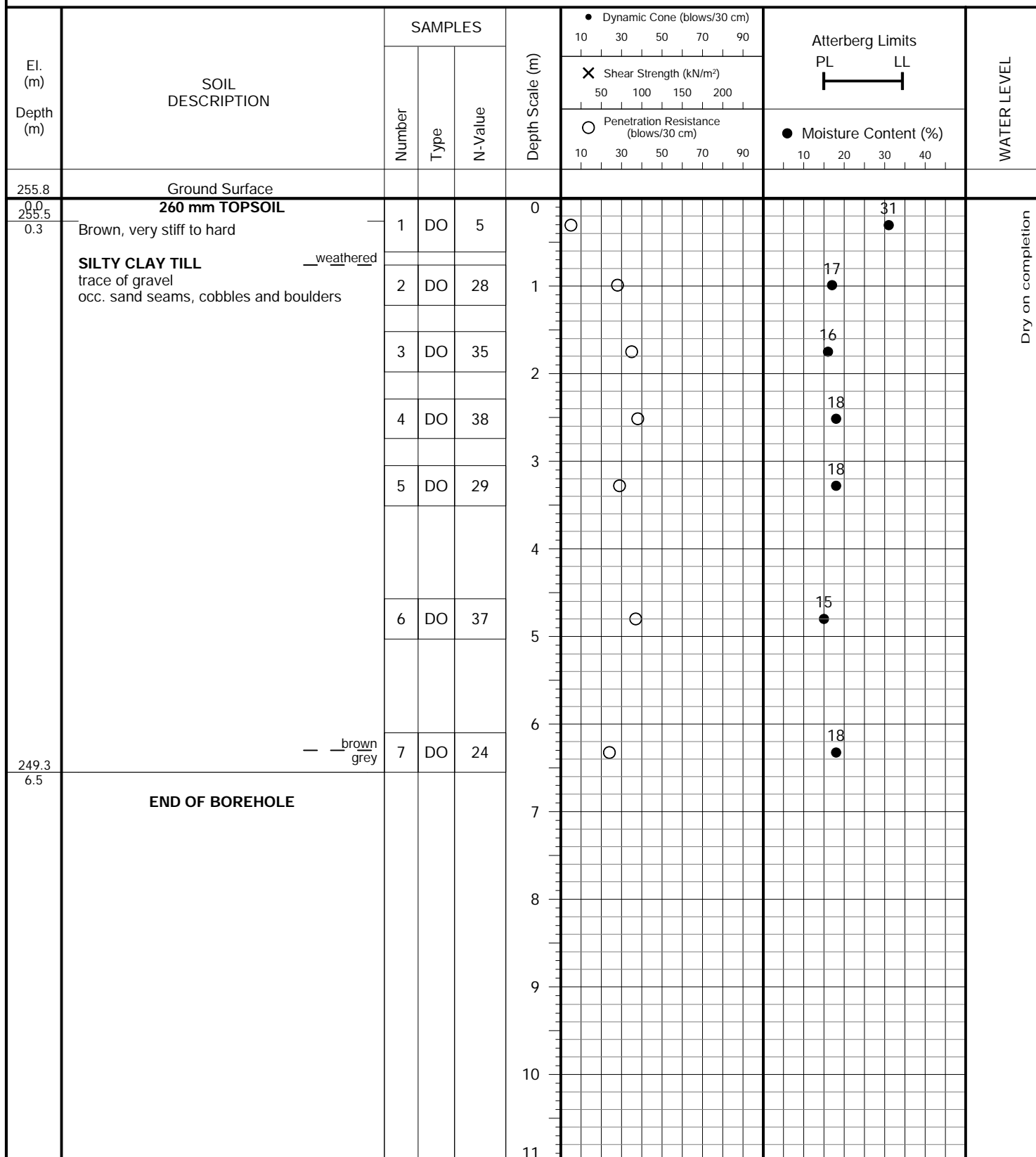
FIGURE NO.: 2

**PROJECT DESCRIPTION:** Proposed Residential Development**METHOD OF BORING:** Flight-Auger  
(Solid-Stem)**PROJECT LOCATION:** Chickadee Lane and Glasgow Road, Town of Caledon**DRILLING DATE:** January 26, 2018**Soil Engineers Ltd.**

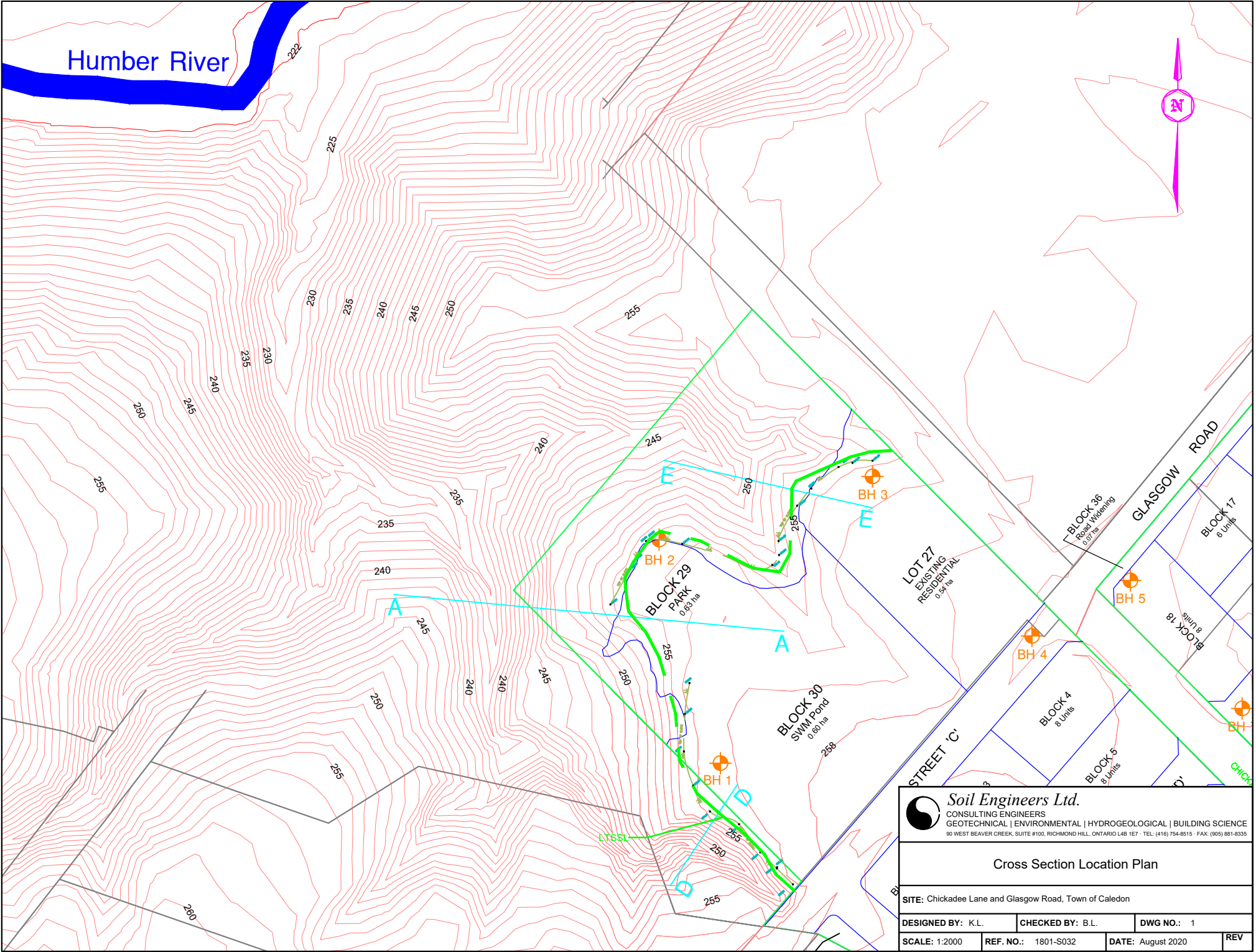
JOB NO.: 1801-S032


**LOG OF BOREHOLE NO.: 3**

FIGURE NO.: 3

**PROJECT DESCRIPTION:** Proposed Residential Development**METHOD OF BORING:** Flight-Auger  
(Solid-Stem)**PROJECT LOCATION:** Chickadee Lane and Glasgow Road, Town of Caledon**DRILLING DATE:** January 26, 2018**Soil Engineers Ltd.**





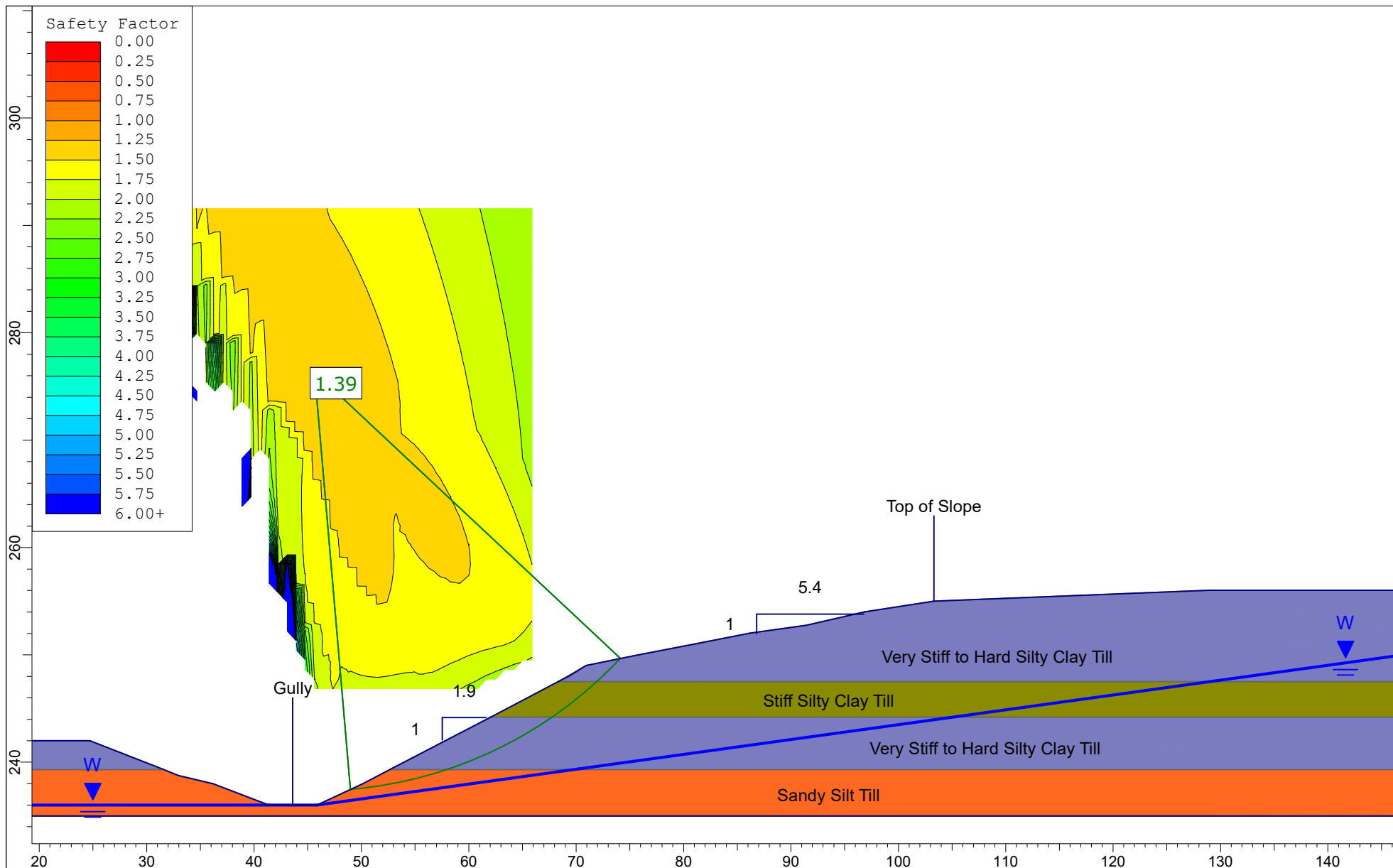


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**Cross Section Location Plan**

**SITE:** Chickadee Lane and Glasgow Road, Town of Caledon

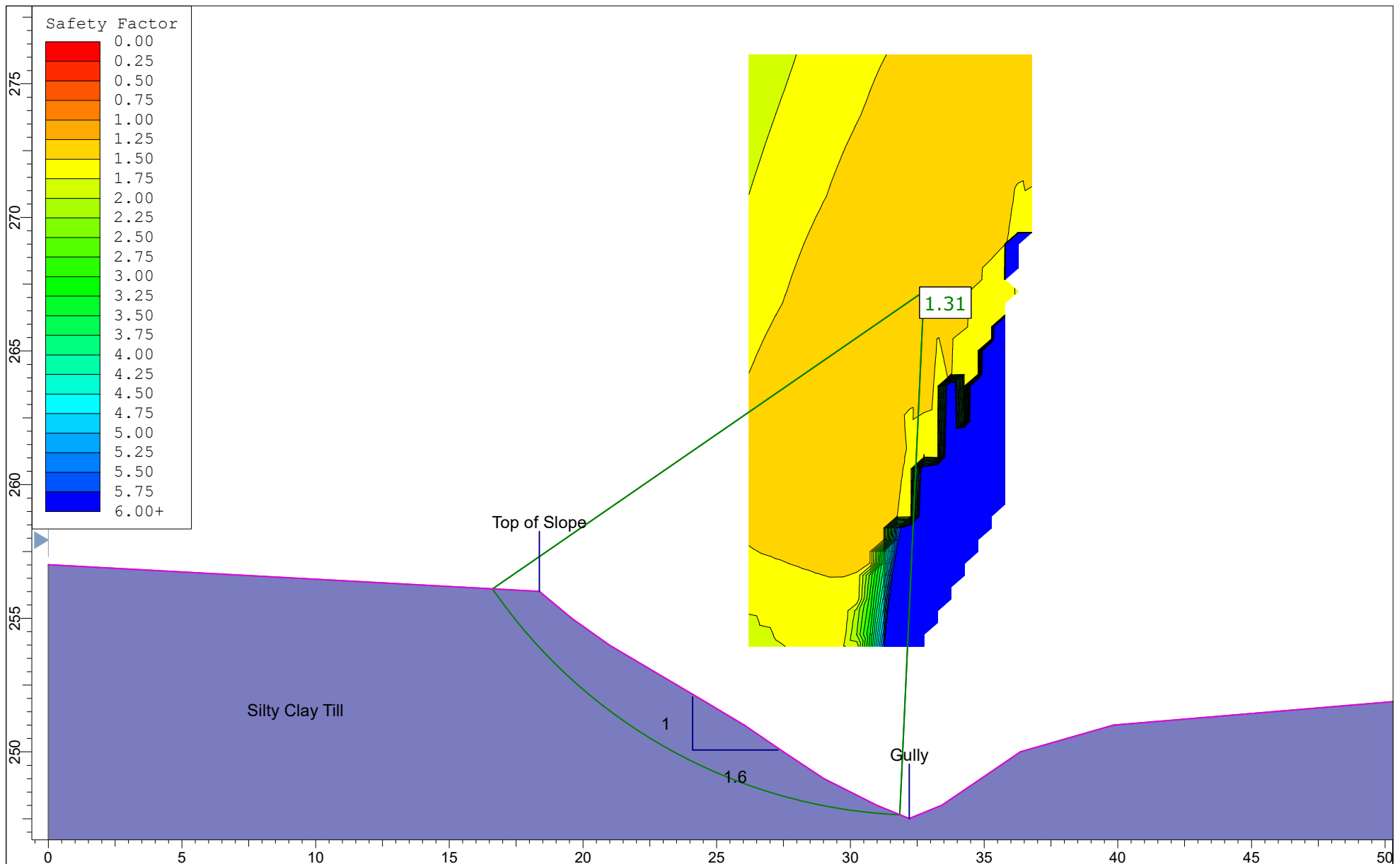
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<b>SCALE:</b> 1:2000	<b>REF. NO.:</b> 1801-S032	<b>DATE:</b> August 2020
		<b>REV</b>




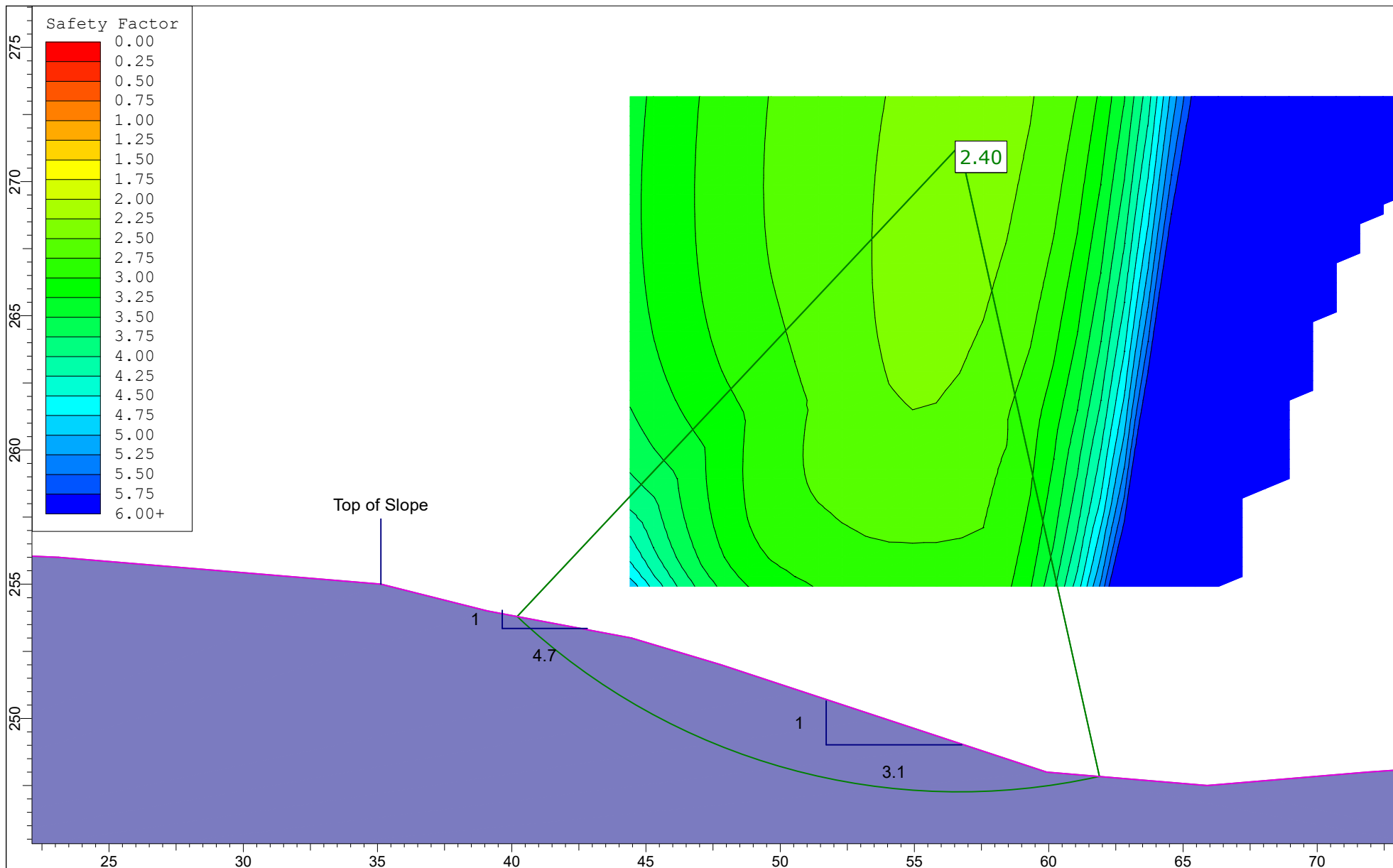
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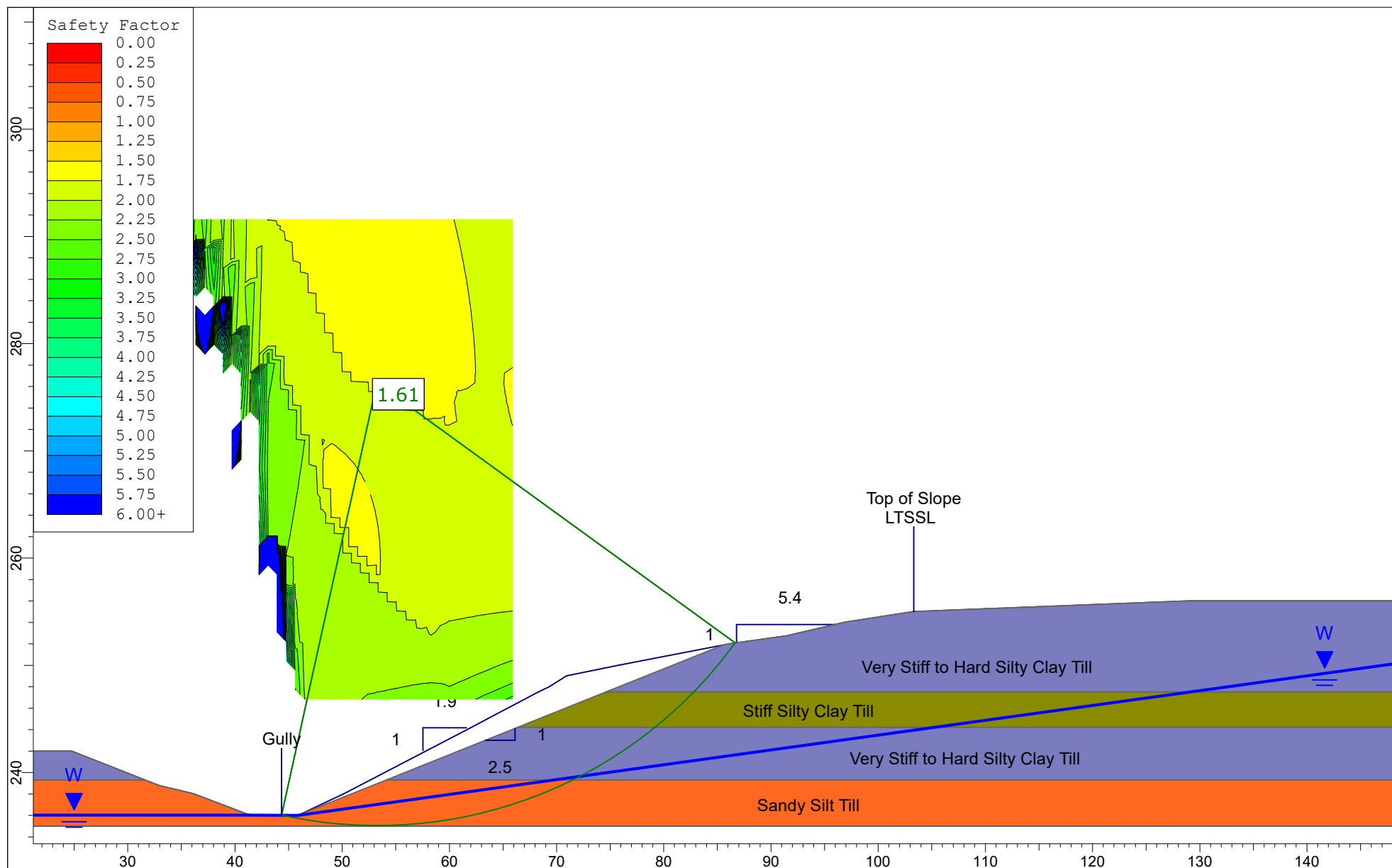
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Slope Stability Assessment - Cross Section A-A			Existing Condition
Location			
Chickadee Lane and Glasgow Road, Town of Caledon			
Drawn By	K.L.	Checked By	B.L.
Scale	1:500		
Revision	-		
Date	August 2020		Reference No.
			1801-S032
Drawing No.	2		



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	Slope Stability Assessment - Cross Section D-D			Existing Condition	
	Location				
	Chickadee Lane and Glasgow Road, Town of Caledon				
Drawn By	K.L.	Checked By	B.L.	Scale	Revision
				1:200	-
Date	August 2020			Reference No.	Drawing No.
				1801-S032	3



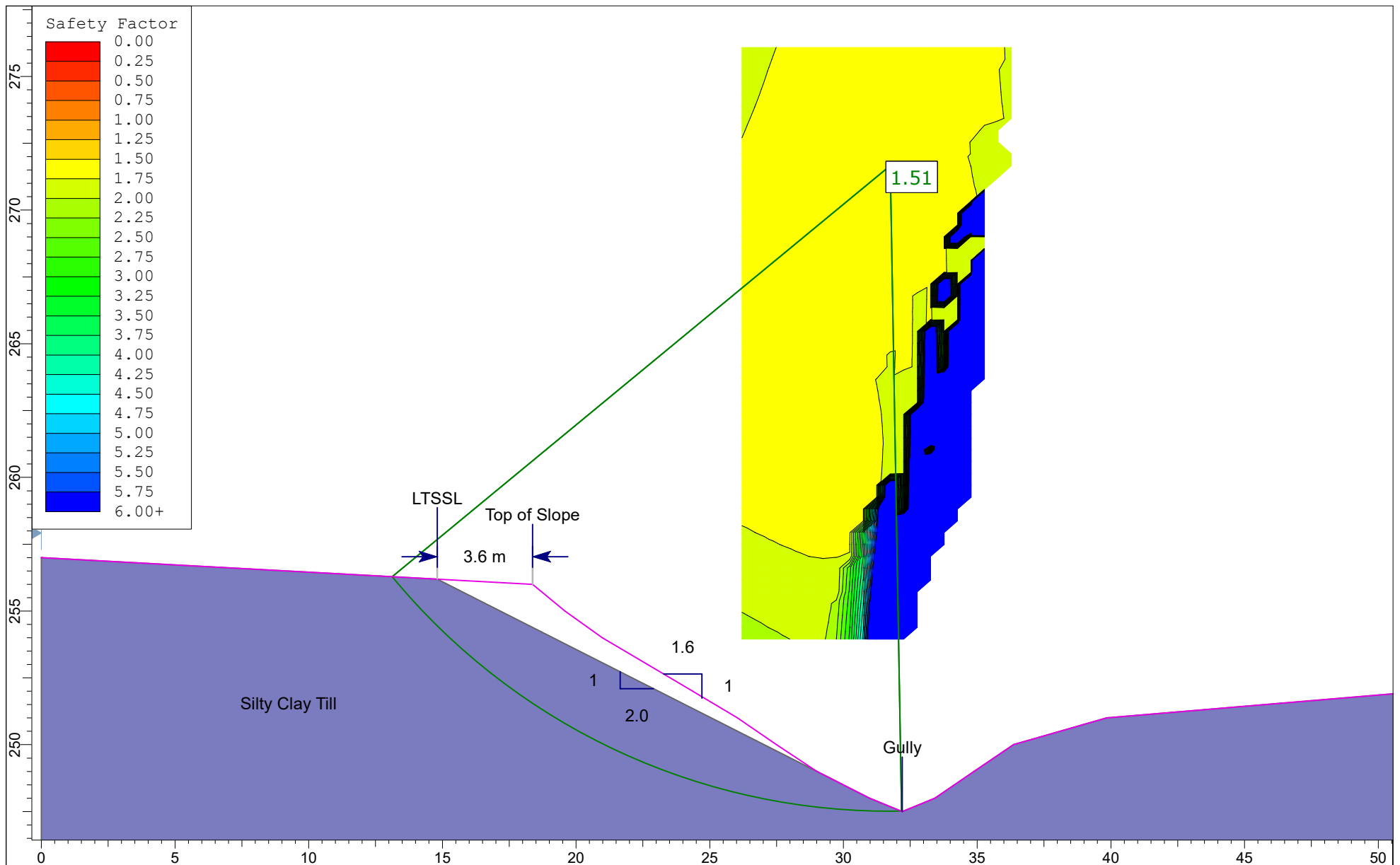
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	Slope Stability Assessment - Cross Section E-E		Existing Condition
	Location		
	Chickadee Lane and Glasgow Road, Town of Caledon		
Drawn By	K.L.	Checked By	B.L.
Scale	1:200		Revision
Date	August 2020		-
Reference No.	1801-S032		Drawing No.
			4




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Project Title				Slope Stability Assessment - Cross Section A-A		Load Case		Geotechnically Stable Condition											
Location										Chickadee Lane and Glasgow Road, Town of Caledon									
Drawn By		K.L.		Checked By		B.L.		Scale		1:500		Revision		-					
Date		August 2020				Reference No.		1801-S032				Drawing No.		5					



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	Location		Chickadee Lane and Glasgow Road, Town of Caledon		Geotechnically Stable Condition
	Drawn By	K.L.	Checked By	B.L.	Scale
	Date	August 2020	Reference No.	1801-S032	Revision
					-
					Drawing No.
					6